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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/698,002	10/30/2003	Shinobu Sakurada	1300-000008	7421

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EXAMINER	
HON, SOW FUN	

ART UNIT	PAPER NUMBER
1772	

MAIL DATE	DELIVERY MODE
07/12/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/698,002	SAKURADA ET AL.	
	Examiner	Art Unit	
	Sow-Fun Hon	1772	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12/05/07*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *30 October 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Withdrawn Rejections

1. The 35 U.S.C. 103(a) rejections of claims 1-3 over in view of are withdrawn due to Applicant's arguments dated 12/05/07.

New Rejections

Claim Objections

2. Claims 2-3 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim, namely process claim 1. In the instant case, claims 2-3 are product-by-process claims. Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. See MPEP 2113. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claim 12 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Applicant discloses that a phase angle characteristic of the impedance of the organic semiconductor material in a frequency range of 100 Hz ≤ f ≤ 1 MHz, is measured when the organic semiconductor material is in an isotropic state and is held between a pair of opposed substrates with an interelectrode spacing of 9 μm (specification, page 4, lines 23-36, page 5, lines 1-4), but this is not clearly written in the claim. Specifically, the phrase "in such a state that" should be substituted with the term "when" for clarity.

Claim Rejections - 35 USC § 102

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. Claims 2-3 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Hanna (JPO Website Machine English Translation of JP2001-075297).

Hanna teaches an organic material having rodlike low-molecular liquid crystallinity (liquid crystal compound has a cylindrical molecular structure, Means section, [0011]), comprising a skeleton structure comprising L 6 π electron aromatic rings, M 10 π electron aromatic rings, and N 14 π electron aromatic rings, wherein L, M, N are each an integer of 0 (zero) to 4 and L+M+N = 1 to 4 (pi-electron system ring,

l+m+n=1-4, core, Means section, [0011]). Hanna teaches a terminal structure attached to both ends of the skeleton structure, such as an alkyl group and an alkoxy group (each of this benzene ring and naphthalene ring has side chains, Means section, [0011]), which are capable of developing liquid crystallinity as defined by Applicant (Specification, page 3, lines 11-13, 33-36).

Although Hanna fails to teach that the phase angle θ of impedance of said organic semiconductor material is $80° \leq \theta \leq 90°$ as determined in the measurement of impedance in a frequency f range of $100\ Hz \leq f \leq 1\ MHz$ when said organic semiconductor material is in an isotropic phase state and is held between a pair of opposed substrates with an inter-electrode spacing of 9 μm, Hanna teaches that both the electron mobility and the positive hole mobility, of the organic material having rodlike low-molecular liquid crystallinity, are greater than or equal to $1 \times 10^{-5}\ cm^2/V.sec$ (abstract). Applicant teaches that the same organic semiconductor material described above, has electron and positive hole mobilities of greater than or equal to $1 \times 10^{-5}\ cm^2/V.sec$ when the phase angle θ of impedance of said organic semiconductor material is $80° \leq \theta \leq 90°$ as determined in the measurement of impedance in a frequency f range of $100\ Hz \leq f \leq 1\ MHz$ when said organic semiconductor material is in an isotropic phase state and is held between a pair of opposed substrates with an inter-electrode spacing of 9 μm (charge mobility of the purified organic semiconductor material was found to be not less than, Specification, page 15, lines 17-20, page 11, lines 30-36, page 12, lines 1-10). Thus, although Hanna fails to disclose that the phase angle θ of impedance of said organic semiconductor material is $80° \leq \theta \leq 90°$ as

determined in the measurement of impedance in a frequency f range of 100 Hz ≤ f ≤ 1 MHz when said organic semiconductor material is in an isotropic phase state and is held between a pair of opposed substrates with an inter-electrode spacing of 9 μm, where the claimed and prior art products are identical or substantially identical in structure and composition, or are produced by identical or substantially identical processes, a prima facie case of either anticipation or obviousness has been established, and the claimed properties are presumed to be inherent. See MPEP 2112.01. If there were to be any differences in structure or chemistry, these differences are presumed to be minor and obvious in the absence of evidence to the contrary.

In addition, Hanna teaches an organic semiconductor element comprising a functional layer comprising the organic semiconductor material described above (The ferroelectric liquid crystal nature charge transportation ingredient used as a barrier layer of a thin film transistor, Means section, [0023], [which is a semiconductor]). Hanna teaches that at least a part of the organic semiconductor material is in a crystal phase (crystalline material, abstract). Although Hanna fails to disclose that the functional layer has been formed by heating said organic semiconductor material to a temperature high enough for the organic semiconductor material to exhibit at least a smectic phase and then cooling the organic semiconductor material, Hanna does teach that the organic semiconductor layer has a molecular orientation that is smectic, and exhibits a smectic phase, for the purpose of providing good charge-carrier transport properties (carrier-mediated transport is performed good, Means, [0012]. Even though product by process claims are limited by and defined by the process, determination of patentability is based

on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process. See MPEP 2113.

Claim Rejections - 35 USC § 103

5. Claim 1 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hanna (JPO Website Machine English Translation of JP2001-075297) in view of Bloom (US 4,141,627).

Hanna teaches an organic material having rodlike low-molecular liquid crystallinity (liquid crystal compound has a cylindrical molecular structure, Means section, [0011]), comprising a skeleton structure comprising L 6 π electron aromatic rings, M 10 π electron aromatic rings, and N 14 π electron aromatic rings, wherein L, M, N are each an integer of 0 (zero) to 4 and L+M+N = 1 to 4 (pi-electron system ring, l+m+n=1-4, core, Means section, [0011]). Hanna teaches a terminal structure attached to both ends of the skeleton structure, such as an alkyl group and an alkoxy group (each of this benzene ring and naphthalene ring has side chains, Means section, [0011]), which are capable of developing liquid crystallinity as defined by Applicant (Specification, page 3, lines 11-13, 33-36). Hanna teaches that when both the electron mobility and positive hole mobility, of the organic material having rodlike low-molecular liquid crystallinity, are greater than or equal to 1×10^{-5} $cm^2/V.sec$, the electron conduction of the organic material is desirably more dominant than ionic conduction

(abstract), which means that the organic material is a semiconductor. Hanna fails to disclose the process of producing the organic semiconductor material which comprises repeatedly purifying the organic semiconductor material to remove ionic impurities such that the phase angle θ of impedance of said organic semiconductor material is $80° \leq \theta \leq 90°$ as determined in the measurement of impedance in a frequency f range of $100\ Hz \leq f \leq 1\ MHz$ when said organic semiconductor material is in an isotropic phase state and is held between a pair of opposed substrates with an inter-electrode spacing of 9 μm.

However, Hanna teaches that when both the electron mobility and the positive hole mobility, of the organic material having rodlike low-molecular liquid crystallinity, are greater than or equal to $1 \times 10^{-5}\ cm^2/V.sec$, the electron conduction of the organic material is desirably more dominant than ionic conduction (abstract). This means that the ionic contribution is desirably minimized. The phase angle θ of an impedance of said organic semiconductor material, as determined in the measurement of the impedance in a frequency f range of $100\ Hz \leq f \leq 1\ MHz$ when said organic semiconductor material is in an isotropic phase state and is held between a pair of opposed substrates with an inter-electrode spacing of 9 μm, inherently improves with improved electron and positive hole mobilities, which are both improved by the reduction of ion conductive impurities using purification methods, as defined by Applicant (Specification, page 5, lines 15-22). It is notoriously well known in the art that the content of ion conductive impurities are reduced by the process steps of repeatedly purifying the liquid crystalline organic material, as evidenced by Bloom.

Bloom teaches that liquid crystalline compounds are repeatedly purified (rigorously, column 3, lines 1-2) to remove impurities which include ionic ones (column 3, lines 1-5).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made, to have optimized a process for producing the organic semiconductor material having rodlike low-molecular liquid crystallinity of Hanna, which comprises the steps of repeatedly purifying the organic semiconductor material to reduce the ionic impurities, as taught by Bloom, in order to improve both the electron mobility and the positive hole mobility of the organic material having rodlike low-molecular liquid crystallinity, taught by Hanna, such that the phase angle θ of impedance of said organic semiconductor material is inherently within the claimed range of $80^\circ \leq \theta \leq 90^\circ$ as determined in the measurement of impedance in a frequency f range of $100\ Hz \leq f \leq 1\ MHz$ when said organic semiconductor material is in an isotropic phase state and is held between a pair of opposed substrates with an inter-electrode spacing of 9 μm.

Response to Arguments

6. Applicant's arguments with respect to claims 1-3 have been considered but are moot in view of the new ground(s) of rejection.

Any inquiry concerning this communication should be directed to Sow-Fun Hon whose telephone number (571)272-1492. The examiner can normally be reached Monday to Friday from 10:00 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Rena Dye, can be reached on (571)272-3186. The fax phone number for the organization where this application or proceeding is assigned is (571)273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

S. Hon

Sow-Fun Hon

07/02/07